

Modeling & Simulation as a Service (M&SaaS)

NASA Phase II SBIR

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Computing Outside the Box®



Corporate Overview



› Parabon Computation, Inc.

- Founded in 1999
- Launched Frontier® in 2000, making it the first commercial (COTS) grid solution
- Operates the only brokered computation service
- Deploys Frontier Enterprise for secure private grids
- Has customers in the government, academic, non-profit and private sectors
- Is a privately-held business in Reston, VA

Overview

- › Primary Objective and Benefit
- › Key M&SaaS Concepts
- › M&SaaS Architecture
- › M&SaaS Video
- › Q&A

Primary Objective & Benefit

- › **Objective:** Enable most modeling and simulation (M&S) activities – from code development and compilation to runtime execution and post-run analysis and collaboration – to be performed from a standard web browser and powered by cloud- and grid-enabled computing resources.

Primary Objective & Benefit

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“Google Docs++ for M&S”

Primary Objective & Benefit

- › **Objective:** Enable most modeling and simulation (M&S) activities – from code development and compilation to runtime execution and post-run analysis and collaboration – to be performed from a standard web browser and powered by cloud- and grid-enabled computing resources.
- › **Benefit:** Allow M&S users and developers alike to avoid many of the obstacles that currently confound the delivery, accessibility and usability of traditional, non-service-oriented (“tarball”) software applications, particularly models and simulations.

M&SaaS Concepts

- Everything is Service-Oriented
 - **Software as a Service (SaaS)**
Delivery model
 - Browser-based access to software
 - **Platform as a Service (PaaS)**
Development environment
 - Browser-based development
 - **Infrastructure as a Service (IaaS)**
Operational environment
 - Grid-based access to resources

M&SaaS Concepts

- Members coalesce around a code **project**
- Projects consist of:
 - Applications
 - Actors & Roles
 - Tools
 - Libraries
 - Documentation
 - Releases
 - Build Environments
 - Forums / Wikis
 - Application variants
 - Sample Input Data
 - Reference Data
 - Results
 - Repositories / SCM
 - Execution Environments

M&SaaS Concepts

- A **division of labor** exists among **actors**
 - Core Developer
 - Domain Programmer
 - QA Tester
 - End User
- Actors form **code-centric communities**

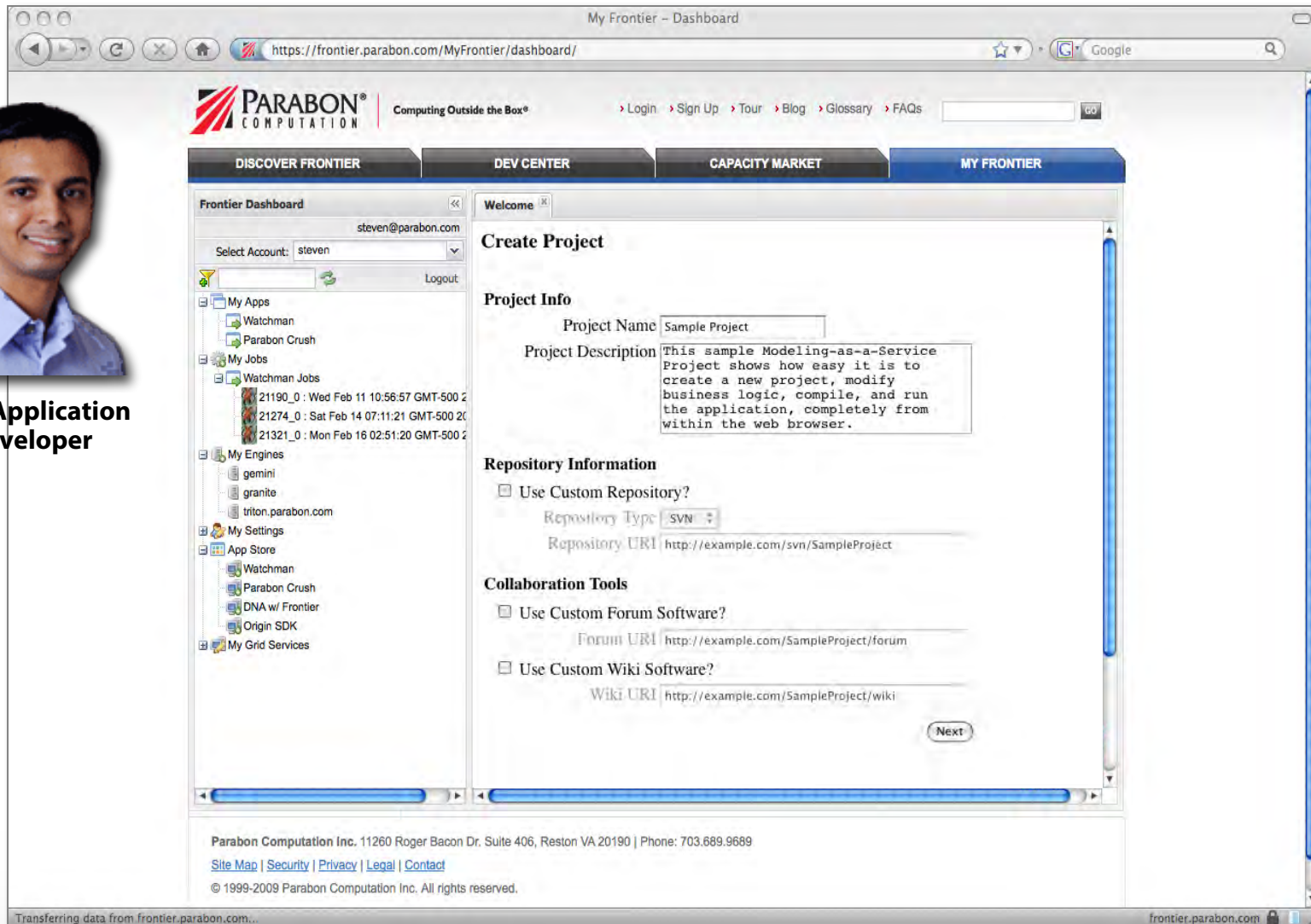
Code-Centric Community: Actors



Code-Centric Community: Actors



Core Application Developer

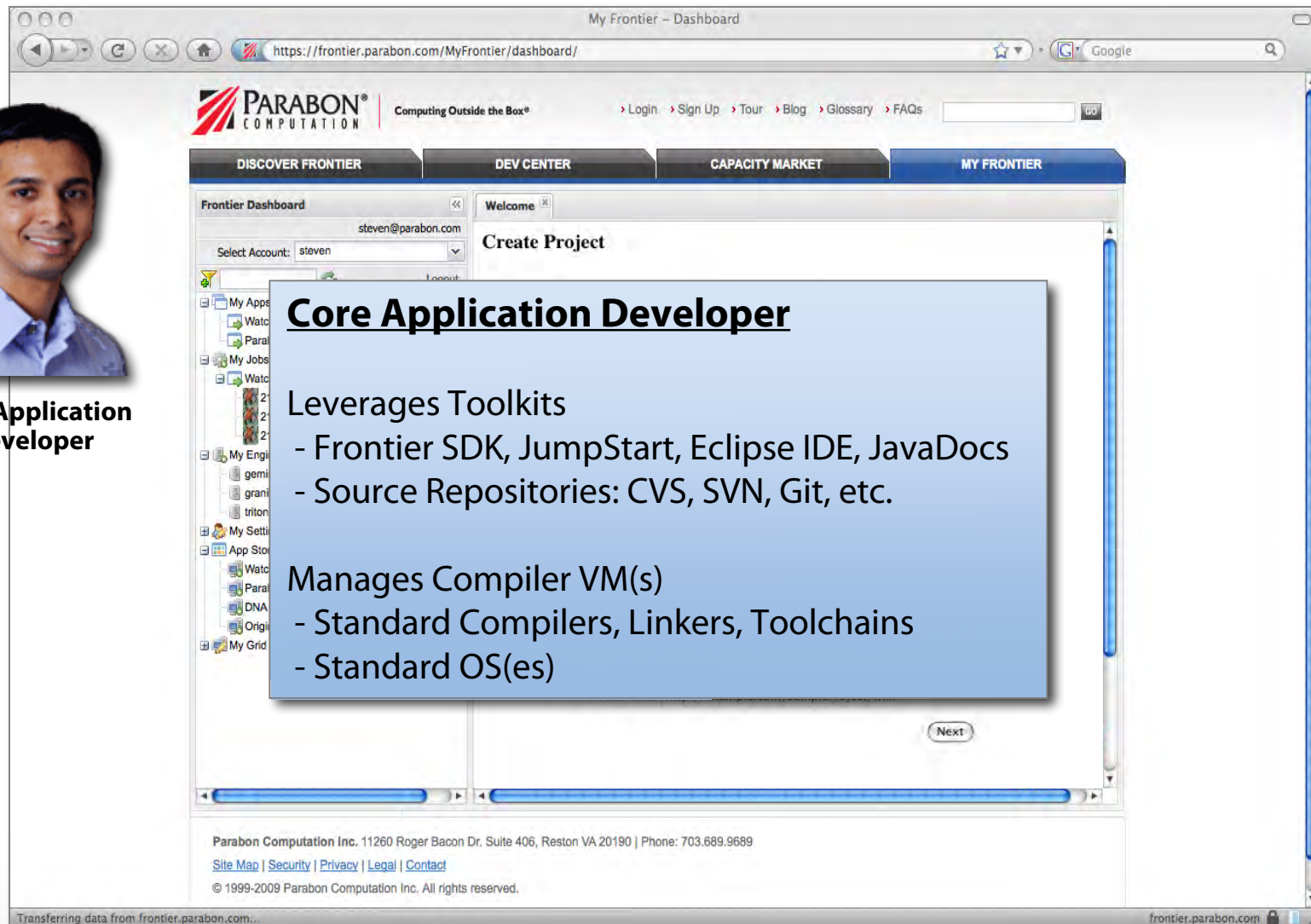


The screenshot displays the 'My Frontier' dashboard of the Paragon Computation system. The interface includes a navigation bar with tabs for 'DISCOVER FRONTIER', 'DEV CENTER', 'CAPACITY MARKET', and 'MY FRONTIER'. The 'MY FRONTIER' tab is active, showing a 'Welcome' message and a 'Create Project' form. The form is divided into sections: 'Project Info' (with fields for Project Name and Project Description), 'Repository Information' (with checkboxes for 'Use Custom Repository?' and fields for 'Repository Type' and 'Repository URI'), and 'Collaboration Tools' (with checkboxes for 'Use Custom Forum Software?' and 'Use Custom Wiki Software?' and fields for 'Forum URI' and 'Wiki URI'). A 'Next' button is located at the bottom right of the form. The left sidebar contains a tree view of the user's account, including 'My Apps', 'My Jobs', 'My Engines', 'My Settings', 'App Store', and 'My Grid Services'. The footer of the dashboard provides contact information for Paragon Computation Inc. and copyright details.

Code-Centric Community: Actors



Core Application Developer



Code-Centric Community: Actors



Core Application Developer



Domain Programmer

The screenshot displays the 'My Frontier' dashboard of the Paragon Computation system. The browser address bar shows the URL <https://frontier.parabon.com/MyFrontier/dashboard/>. The dashboard includes a navigation bar with tabs for 'DISCOVER FRONTIER', 'DEV CENTER', 'CAPACITY MARKET', and 'MY FRONTIER'. The 'MY FRONTIER' tab is active, showing a 'Frontier Dashboard' for user 'steven@parabon.com'. On the left, a sidebar lists various components: 'My Apps' (Watchman, Paragon Crush), 'My Jobs' (Watchman Jobs with a list of jobs), 'My Engines' (gemini, granite, triton.parabon.com), 'My Settings', 'App Store', and 'My Grid Services'. The main area is titled 'Edit Source' and contains a code editor with the following Java code:

```
public RemoteTask(int inputValue) {
    this.inputValue = inputValue;
}

public Integer run(SerializableTaskContext context) {
    context_ = context;

    int numProcs = Runtime.getRuntime().availableProcessors();
    Thread[] threads = new Thread[numProcs];
    final int candidate = candidate_;

    for (int i = 0; i < numProcs; i++) {
        threads[i] = new Thread() {
            public void run() {
                try {
                    boolean b = ExecuteModelForCandidate(candidate);
                    setResult(b);
                } catch (TaskStoppedException tse) {
                    setTaskStoppedException(tse);
                }
            }
        };
        threads[i].start();
    }
}
```

Buttons for 'Load', 'Save', 'Commit', 'Compile', and 'Launch' are visible. The footer of the dashboard provides contact information for Paragon Computation Inc. and copyright details.

Code-Centric Community: Actors



Core Application Developer



Domain Programmer

My Frontier - Dashboard

https://frontier.paragon.com/MyFrontier/dashboard/

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DISCOVER FRONTIER DEV CENTER CAPACITY MARKET MY FRONTIER

Frontier Dashboard

Welcome steven@paragon.com

Select Account: steven Logout

My Apps

- Watchman
- Parabon C

My Jobs

- Watchman
- 21190_
- 21274_
- 21321_

My Engines

- gemini
- granite
- triton.parat

My Settings

App Store

- Watchman
- Parabon C
- DNA w/ Fro
- Origin SDK
- My Grid Servi

Edit Source

Load Save Commit

```
public RemoteTask(int inputValue) {
    this.inputValue = inputValue;
}
```

Domain Programmer

Tweaks Science/Business Application Logic

- Programs in Fortran, R, Scheme, etc.
- Uses Integrated Text Editor
- Creates Branches and/or Variants
- Builds against Standard Compile VMs
- Collaborates via Forums and/or Wikis

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frontier.paragon.com

Code-Centric Community: Actors



Core Application Developer



Domain Programmer



QA Tester

My Frontier - Dashboard

https://frontier.paragon.com/MyFrontier/dashboard/

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DISCOVER FRONTIER DEV CENTER CAPACITY MARKET MY FRONTIER

Frontier Dashboard

Welcome

Select Account: steven Logout

My Apps

- Watchman
- Paragon Crush

My Jobs

- Watchman Jobs
- 21190_0 : Wed Feb 11 10:56:57 GMT-500 2
- 21274_0 : Sat Feb 14 07:11:21 GMT-500 2
- 21321_0 : Mon Feb 16 02:51:20 GMT-500 2

My Engines

- gemin
- granite
- triton.paragon.com

My Settings

App Store

- Watchman
- Paragon Crush
- DNA w/ Frontier
- Origin SDK

My Grid Services

Compile Code

Select Build Environment

- ☐ Java 1.5 SDK; RedHat Enterprise Linux 5; GCC 4.2
- ☐ Java 1.6 SDK; RedHat Enterprise Linux 5; GCC 4.2
- ☒ Java 1.6 SDK; SuSE Enterprise Linux 10; GCC 4.3
- ☐ Java 1.6 SDK; OpenSuSE 11.2 Linux; GCC 4.3

Select Build Architecture

- ☐ Intel x86 (32-bit)
- ☐ AMD x86 (32-bit)
- ☒ AMD x86_64 (64-bit)

Specify Build System

- ☐ Make
- ☒ Ant
- ☐ Maven

Additional Command-Line Arguments

Compile

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Code-Centric Community: Actors



Core Application Developer



Domain Programmer



QA Tester

My Frontier - Dashboard

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DISCOVER FRONTIER DEV CENTER CAPACITY MARKET MY FRONTIER

Frontier Dashboard

Welcome

Select Account: steven Logout

My Apps

Watchman

Parabon

My Jobs

Watchman

2119

2127

2132

My Engines

gemini

granite

triton.pa

My Settings

App Store

Watchman

Parabon

DNA w/

Origin S

My Grid Se

Compile Code

Select Build Environment

Java 1.5 SDK; RedHat Enterprise Linux 5; GCC 4.2

Java 1.6 SDK; RedHat Enterprise Linux 5; GCC 4.2

QA Tester

Runs Applications and Various Logic Modules against Standard QA Environment(s)

- Selects VM(s) for Compile (Build) Time
- Selects VM(s) for Execution (Run) Time
- Automates Unit Testing

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Code-Centric Community: Actors



Core Application Developer



Domain Programmer

My Frontier -- Dashboard

https://frontier.parabon.com/MyFrontier/dashboard/

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DISCOVER FRONTIER DEV CENTER CAPACITY MARKET MY FRONTIER

Frontier Dashboard

Welcome

Select Account: steven Logout

My Apps

- Watchman
- Parabon Crush

My Jobs

- Watchman Jobs
- 21190_0 : Wed Feb 11 10:56:57 GMT-500 2
- 21274_0 : Sat Feb 14 07:11:21 GMT-500 2
- 21321_0 : Mon Feb 16 02:51:20 GMT-500 2

My Engines

- gemini
- granite
- triton.parabon.com

My Settings

App Store

- Watchman
- Parabon Crush
- DNA w/ Frontier
- Origin SDK
- My Grid Services

Run Application

Input File (.xml)

/home/orbit/Documents/ProjectData/input.xml Browse...

Region

Upper-Left Corner -- Latitude: 39.000 N; Longitude: -76.860 E

Lower-Right Corner -- Latitude: 38.992 N; Longitude: -76.846 E

Flux Capacitor

Power: 1.21 Jiggawatts

Speed: 88 MPH

Date: Nov 5 th. 1955

Launch

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
QA Tester



End User

Code-Centric Community: Actors



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Code-Centric Community: Actors



Core Application Developer



Domain Programmer

My Frontier – Dashboard

https://frontier.parabon.com/MyFrontier/dashboard/

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DISCOVER FRONTIER | DEV CENTER | CAPACITY MARKET | MY FRONTIER

Frontier Dashboard | steven@parabon.com

Select Account: steven | Logout

My Apps: Watchman, Parabon Crush

My Jobs: Watchman Jobs

21190_0 : Wed Feb 11 10:56:57 GMT-500 2
21274_0 : Sat Feb 14 07:11:21 GMT-500 20
21321_0 : Mon Feb 16 02:51:20 GMT-500 2

My Engines: gemini, granite, triton.parabon.com

My Settings: App Store, Watchman, Parabon Crush, DNA w/ Frontier, Origin SDK, My Grid Services

Welcome | Create Project

Project Info: Project Name, Project Description

Repository Information: Use Custom Repository?, Repository URL

Collaboration Tools: Use Custom Forum Software?, Use Custom Wiki Software?

Edit Source:

```
load Save Comment
public RemoteTask(int inputValue) {
    this.inputValue = inputValue;
}

public Integer run(SerializableTaskContext context) {
    context_ = context;
    int sumProcess = Runtime.getRuntime().availableProcessors();
    Thread[] threads = new Thread[sumProcess];
    final int candidate = candidate;
    for (int i = 0; i < sumProcess; i++) {
        threads[i] = new Thread() {
            public void run() {
                boolean b = ExecuteModelForCandidate(candidate);
                netResult(b);
            }
        };
        threads[i].start();
    }
    try {
        Thread.sleep(1000);
    } catch (InterruptedException e) {
        e.printStackTrace();
    }
}

public void netResult(b) {
    // ...
}

Complete Launch
```

Compile Code: Select Build Environment, Select Build Architecture, Specify Build System, Additional Command-Line Arguments

Run Application: Input File (.xml), Region, Flux Capacitor

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QA Tester



End User

Code-Centric Community: Actors



Core Application Developer



Domain Programmer



QA Tester



End User

My Frontier – Dashboard

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DISCOVER FRONTIER DEV CENTER CAPACITY MARKET MY FRONTIER

Frontier Dashboard

Welcome steven@parabon.com

Select Account: steven Logout

Create Project

Project Info

Project Name: Sample Project

Project Description: This sample ModelJsp-as-a-Service Project shows how easy it is to create a new project, modify

Compile Code

Select Build Environment

- ☐ Java 1.5 SDK: RedHat Enterprise Linux 5; GCC 4.2
- ☐ Java 1.6 SDK: RedHat Enterprise Linux 5; GCC 4.2
- ☒ Java 1.6 SDK: SuSE Enterprise Linux 10; GCC 4.3
- ☐ Java 1.6 SDK: OpenSUSE 11.2 Linux; GCC 4.3

My Apps

- Watch
- Parabon

My Jobs

- Watch
- 211
- 212
- 213

My Engine

- gemini
- granite
- triton.p

My Setting

App Store

- Watch
- Parabon
- DNA w
- Origin
- My Grid S

Enhanced Productivity

- + Leveraged Skill Sets
- + Fewer Bugs
- + Pipelined Operation

Code-Centric Community

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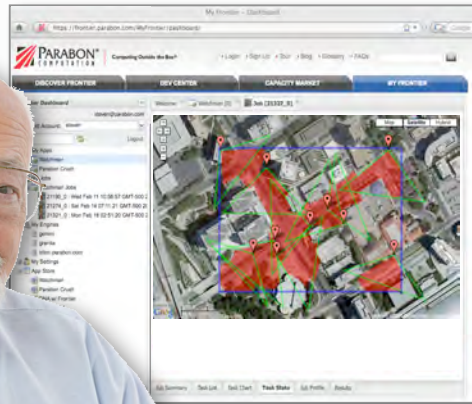
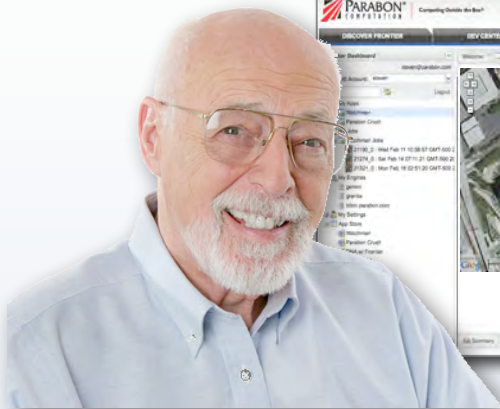
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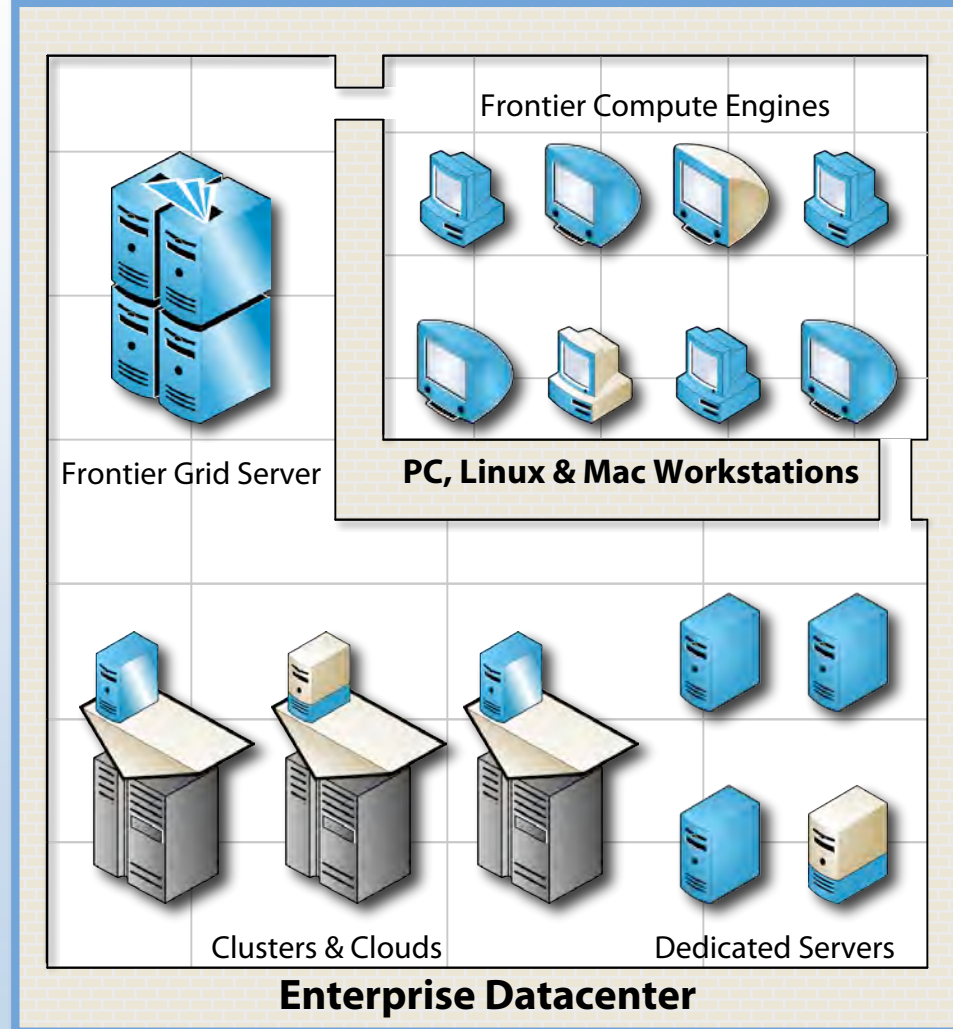
Parabon's Frontier® Grid Platform



Parabon's **Frontier® Grid Platform** is a turn-key, commercial off-the-shelf (COTS) software solution that unobtrusively harnesses unused and/or dedicated computing capacity across enterprise network(s) – allowing you to securely:

- ✓ **Maximize ROI of existing enterprise assets**
 - Use available resources more efficiently
 - **Avoid costly hardware expenditures!**
- ✓ **Solve previously intractable problems**
 - Launch **data-heavy** and **compute-intensive** jobs
 - Manage **distributed command & control** apps
 - Host **cloud computing** web services
- ✓ **Reduce current processing times**
 - From decades to days, or months to minutes

Frontier® Enterprise Grid Deployment



Service Layer Stack



**Frontier's complete service stack provides
Infrastructure, Platform, and Grid Software as a Service layers**



Grid Software as a Service

App Store; Watchman™; Blitz™



Platform as a Service

Frontier Dashboard; JumpStart™ Application Generator



Infrastructure as a Service

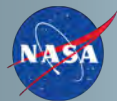
Integrated VM Management; Frontier Server & Compute Engine



Service Layer Stack



**M&SaaS builds upon these service layers
to provide a new generation of M&S capabilities**



M&S as a Service



Grid Software as a Service

App Store; Watchman™; Blitz™



Platform as a Service

Frontier Dashboard; JumpStart™ Application Generator

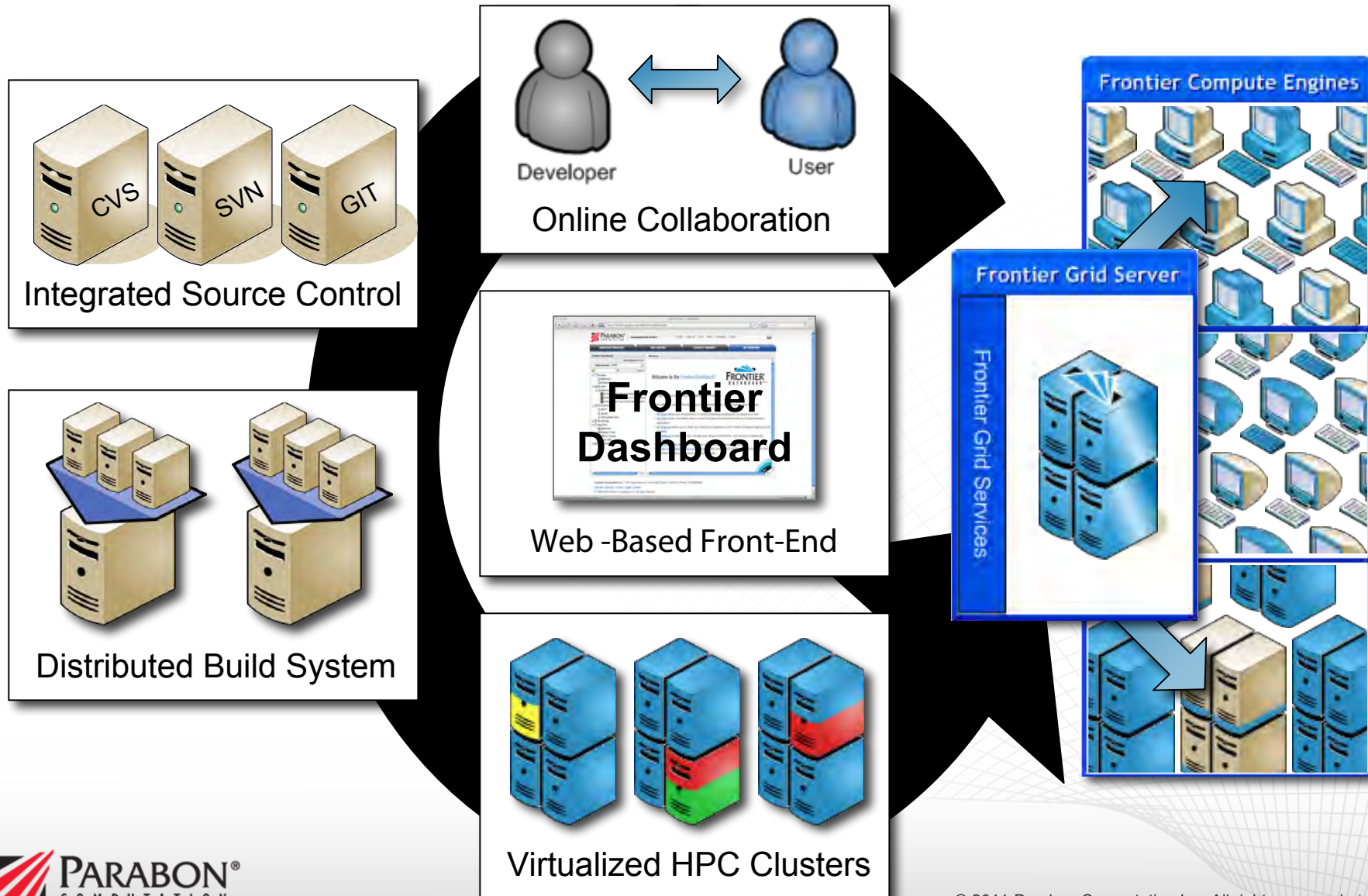


Infrastructure as a Service

Integrated VM Management; Frontier Server & Compute Engine



M&SaaS: Architecture

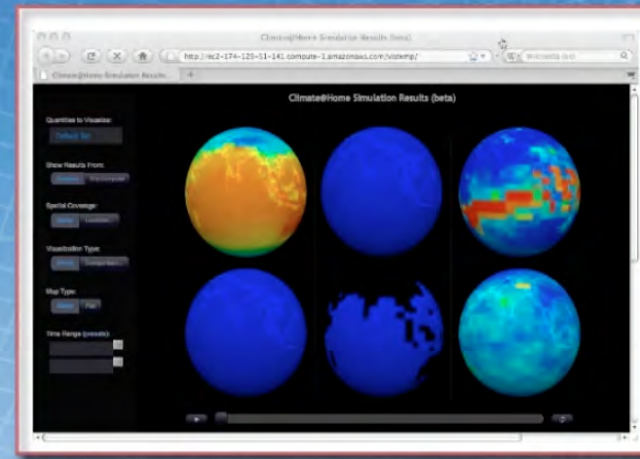


M&SaaS Video



Frontier[®] Grid Platform

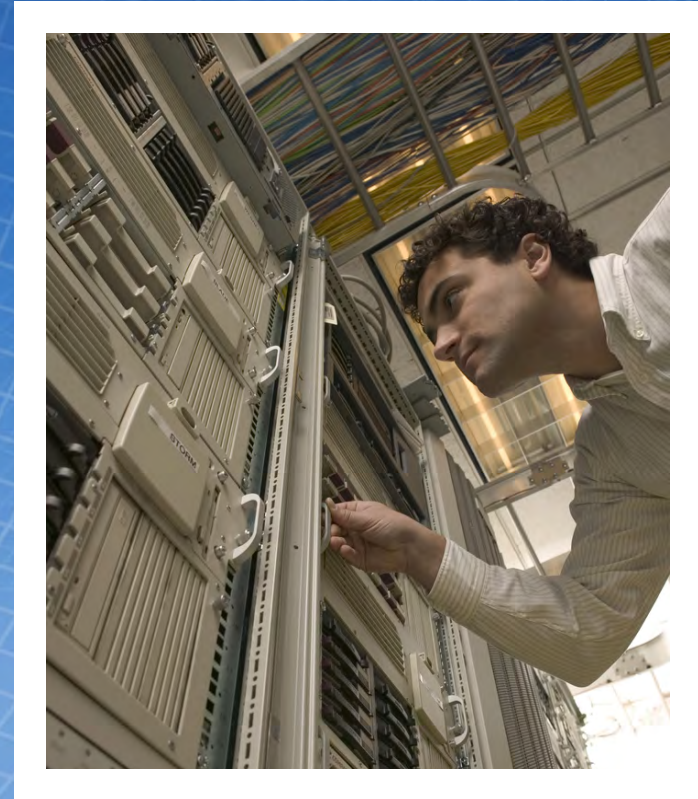
*Modeling & Simulation
as a Service*



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Questions?

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